

1, 156, 8 23

MISCELLANEOUS REPORT NO. 1

8.24

A SURVEY OF FARM-FORESTRY RESEARCH AND DEMONSTRATION NEEDS

IN SOUTHERN MINNESOTA - 1947

By John R. Neetzel, Forester

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Lake States Forest Experiment Station

1947

PURPOSE AND SCOPE

Two and one-half million acres, or nearly 10 percent of the land area, of the 62 Minnesota counties south of Mille Lacs Lake, are forest or woodland. This does not include the planted farmstead windbreaks and field shelterbelts. Observations by the Soil Conservation Service Land Planners and other farm leaders indicate that under good land-use practices, this amount of woodland will be retained or somewhat increased.

Although it has not made an adequate return to the farm in the past, this forest land is potentially of great value. The farm grove offers wind protection to the fields and buildings; the wood lot supplies fuel, posts, and lumber used on the farm; both the shelterbelt and the wood lot furnish shade for livestock; the woods and brush fields offer cover to game and songbirds; and timbered areas are used for camping and other recreational purposes.

The efforts of rural leaders in encouraging the extension of the shelterbelts and starting better management of the wooded areas has resulted in some progress. This is indicated by the increased acreage of ungrazed wood lots listed for some counties by the agricultural census for 1945, as compared to 1935. In Winona County, for example, the protected acreage increased from 12,320 acres in 1935 to 24,417 acres in 1945. Much of the progress in this county can be attributed to the efforts of the Soil Conservation Service.

For the area as a whole, however, progress is disappointingly slow. One of the greatest draw-backs to a program of woodland management is the lack of accurate information on which to base an action program. It is difficult to encourage a farmer to plant a shelterbelt without better knowledge as to tree and shrub species and size classes of stock most likely to succeed under conditions on his farm. The farmer wants to know how fast his wood lot is growing and how much it will return in annual income. If it can furnish a cash income, he will be more interested in improved cutting practices. A landowner is unlikely to fence a wooded tract against pasturing without information on the timber growth and restocking to be expected following such a practice, and the poor quality of forage produced. Agricultural leaders have up-to-date information available for the problems arising from the 90 percent of the farm acreage in crops and pasture, but little or nothing upon which to base recommendations for the 10 percent of the land which is wooded.

The importance of the farmwoods in the conservation of soil and wildlife resources has been recognized, but little or no study has ever been made of the actual cash benefits to be expected.

It is the purpose of this analysis to focus attention on some of the more important problems of the farm-woodland area, and to outline a research program which can furnish information needed to stimulate the establishment and management of shelterbelts and farm wood lots. These research findings should point the way to better land use and increased returns to the farmer.

Assembled by John R. Neetzel, Forester, as part of the Norris-Doxey Farm Forestry Research Project - the Agricultural Experiment Station, University of Minnesota, and the Lake States Forest Experiment Station, University Farm, St. Paul 1, Minnesota, cooperating.

This analysis is not confined to research work which can be completed in a few months or even a few years, but discusses the more important projects which should be included in a long-time program developed over a period of many years.

Including such a wide scope of activities, the projects will require the attention of many individuals and the facilities and leadership of all the public and private agencies in the territory.

The following agencies are known to be interested in various aspects of farmwoods management and may want to participate in carrying on some phases of the research work or in conveying the findings to farmers and other users:

University of Minnesota - Division of Forestry, Agricultural Engineering,
Soils, Agronomy, and Economic Entomology and Zoology
Minnesota Agricultural Extension Service
Minnesota Conservation Department
Soil Conservation Service
Fish and Wildlife Service
Production and Marketing Administration (formerly Agricultural Adjustment
Administration)
Isaac Walton League
Hormel Foundation
Mayo Foundation
Minnesota Federation of Sportsmens Clubs
Minnesota Farm Bureau
Minnesota Grange
Farmers Union
Nurseyemen's Association
United States Forest Service

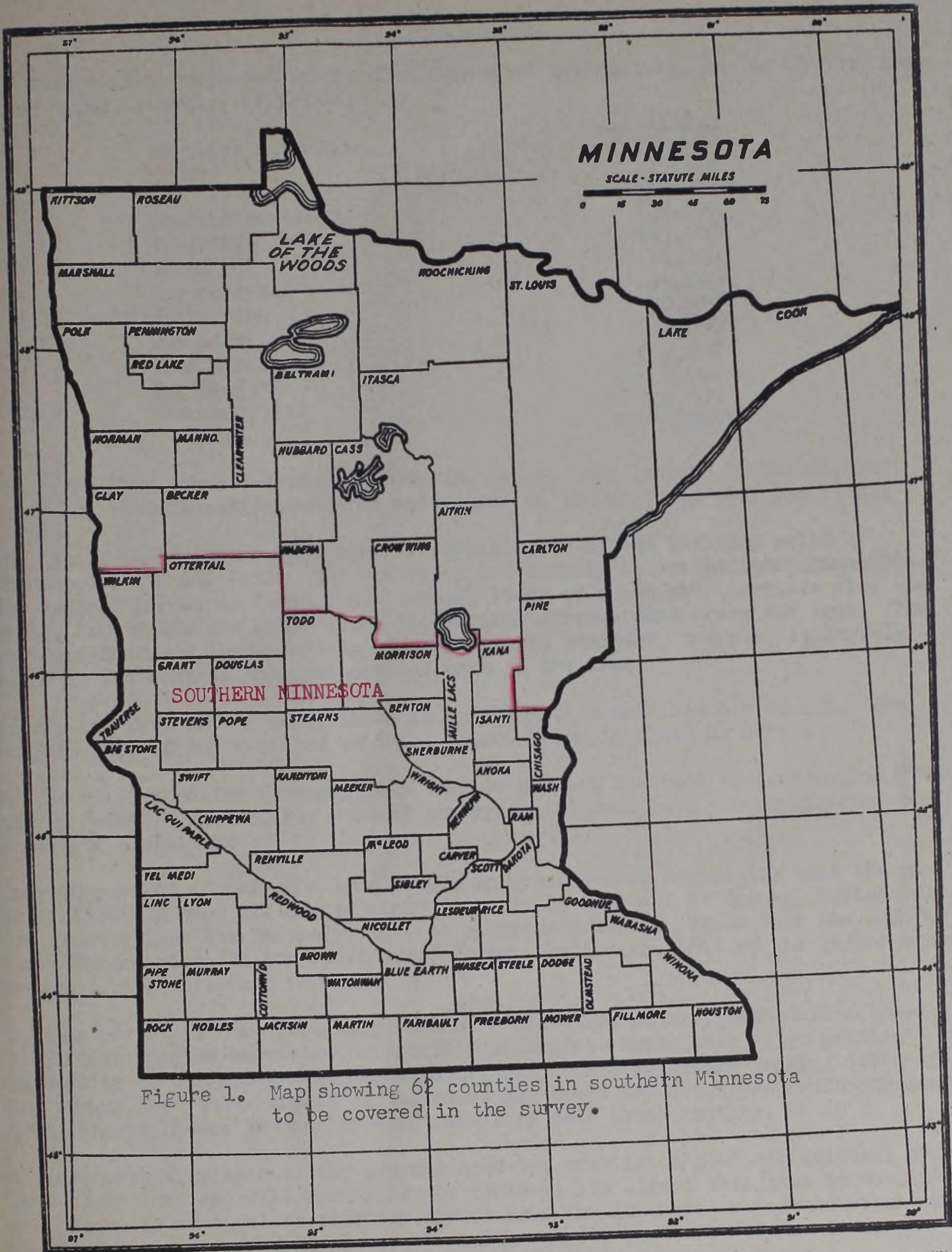
AREA

The area covered in this survey consists of 62 counties in southern Minnesota. (See attached map.) It has a land area of 25,257,000 acres of which 2,500,000 acres are forest. According to the 1945 Census of Agriculture this area contains 2,015,400 acres of farm woodland, of which 372,058 acres are classed as ungrazed. This farmwoods area represents an average of slightly less than 15 acres for each of the 137,345 farms in the territory.

In all counties except Anoka, Isanti, Kanabec, Mille Lacs, Morris, and Sherburne, essentially all of the land area is either in farms or in urban and industrial use. In addition to the farm wood lots in these six counties, there is an estimated 478,004 acres that could be classified as forest and wild land. Most of this acreage is believed to be poorly stocked with timber and is of low productivity. On the other hand, very little of this timberland is being grazed by domestic livestock.

BACKGROUND

For a proper understanding of the farm-forestry research needed in southern Minnesota, the background should be known. For this reason there are sketched briefly such factors as timber types, climate, topography and soil, forest industries, transportation facilities, and biotic factors.



Feb. 1, 1927

Timber Types

The timber area (reported by the 1945 Census of Agriculture) may be divided into cover types, roughly, as follows:

	<u>Acres</u>
Northern hardwoods	680,000
Aspen	570,000
Oak	515,000
Lowland hardwoods	240,000
Tamarack	115,000
Scrub oak	26,000
Spruce swamp	15,000
White pine	10,000
Red pine	10,000
Jack pine	9,000
Spruce-fir	4,000
Noncommercial	306,000
Total	<u>2,500,000</u>

The first five types (northern hardwoods, aspen, oak, lowland hardwoods, and tamarack) include sufficient area and volume of timber to be very important.

The aspen, pine, spruce, and tamarack types occur almost entirely north of Minneapolis and St. Paul. The oak types are largely in southeastern Minnesota. The lowland hardwoods (mostly cottonwood, black or green ash, American elm, soft maple, and willow are found along the various streams that cross the area. The northern-hardwood type, made up of sugar maple, basswood, and elm, is largely found in the central and west-central part of the area.

Nearly one farm out of every three in southern Minnesota has a wood lot. The average size of the woodland on these 46,000 farms is about 44 acres.

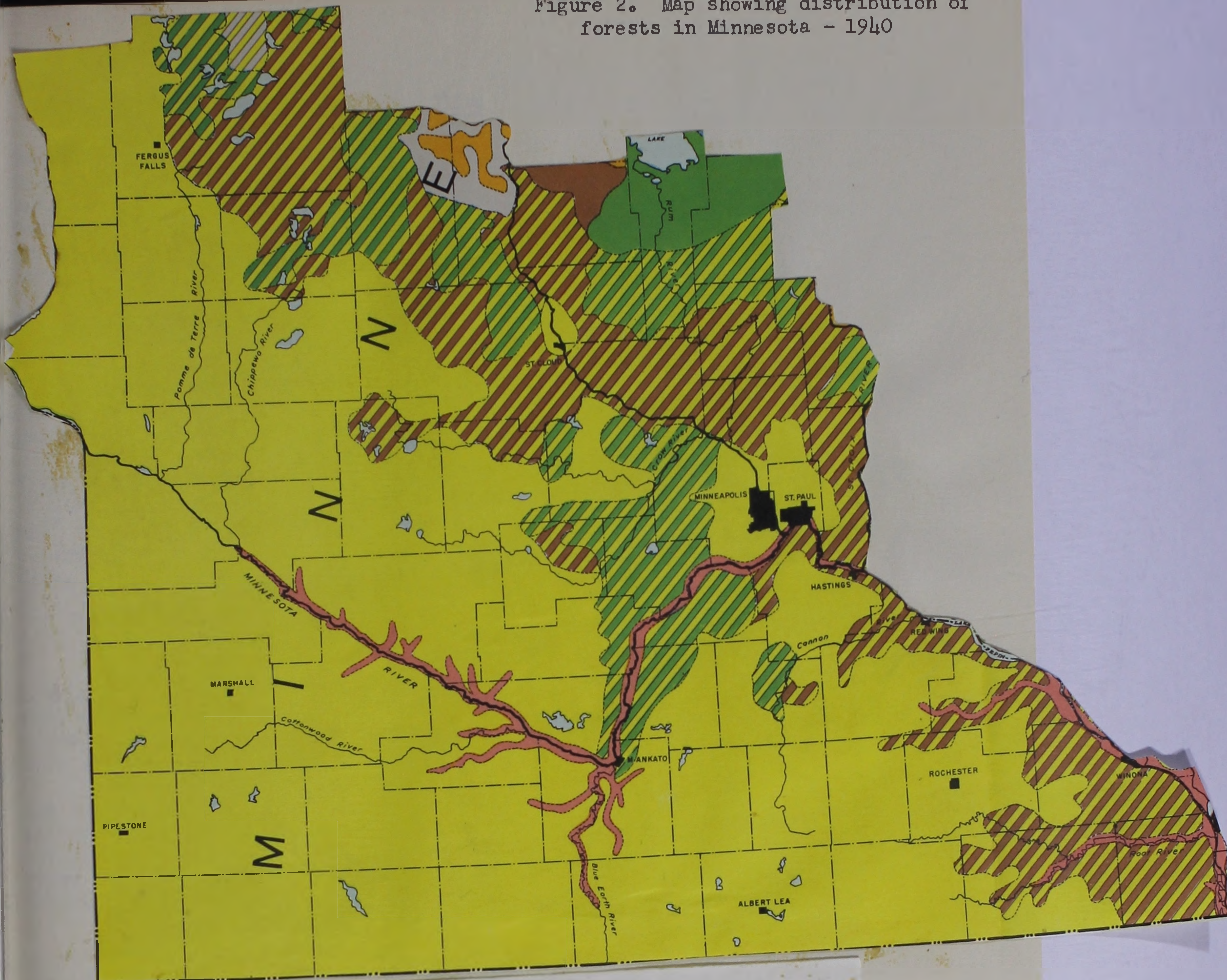
Of the total wood-lot acreage, less than 20 percent has been protected from grazing by domestic livestock. Most of the protected wood lots are now in good to excellent condition.

Over 80 percent of the wood lots have been grazed; some so heavily that the reproduction has been killed and some of the trees are dead or dying. Fortunately the greater part has had only light to moderate grazing. While this has damaged the advanced reproduction and injured forest conditions, most of the larger trees have not been seriously harmed.

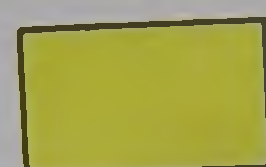
Logging practices have generally been of a selective nature, with mature trees of certain species harvested for specific products. While this "high grading" of species is not necessarily beneficial, still this selective logging opens up the stands for faster growth of the remaining trees and development of reproduction, and is generally much more satisfactory than heavy cutting.


A considerable acreage of the present wood-lot area is on good agricultural crop or pasture land and will eventually be cleared. To offset this loss in woodland area there is an equal or slightly larger area now in crops or pasture which must be planted and returned to timber production as the best use for the land.

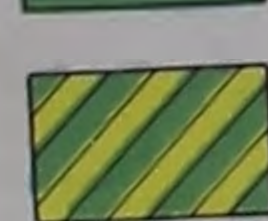
Figure 2. Map showing distribution of forests in Minnesota - 1940

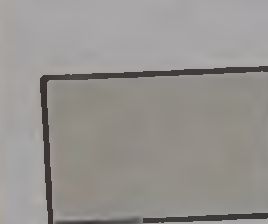


COLOR LEGEND

 Agricultural and Industrial Areas

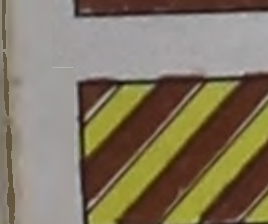
 Northern hardwoods

 Primarily agricultural land, with 15 to 50 % of area supporting Northern hardwoods

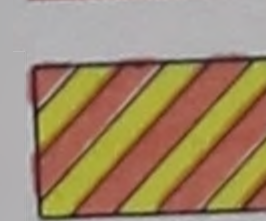
 Aspen, Pincherry, Highland or Swamp brush, Open or Nonregenerating areas, Muskeg

 Primarily agricultural land, with 15 to 50 % of area as above

 Oak

 Primarily agricultural land, with 15 to 50 % of area supporting Oak

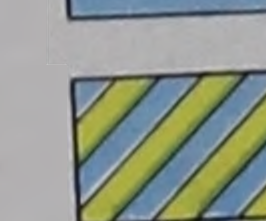
 Lowland hardwoods, River bottoms

 Primarily agricultural land with 15 to 50 % of area supporting Lowland hardwoods, River bottoms

 Pine

 Primarily agricultural land with 15 to 50 % of area supporting Pine

 Spruce, Balsam, Tamarack, Cedar

 Primarily agricultural land with 15 to 50 % of area supporting Spruce, Balsam, Tamarack, Cedar

Climate

The climate varies considerably in southern Minnesota from south to north and west to east. Snowfall, for instance, is about 20 inches in the southern and western parts of the State, and 50 inches in the Minneapolis-St. Paul area. Of special importance to shelterbelts are the extensive periods in winter when much of the ground in the southern and western parts of the State lacks a protective snow cover.

Precipitation varies from 28 to 32 inches, increasing in the eastern and northern part of the area. Much of it occurs as rain during the growing season.

Southern Minnesota has a growing season of from 130 to 160 days. The longest frost-free period occurs along the Iowa border and in the southeastern part of the State along the Mississippi River.

While the mean temperatures are relatively uniform over the area, high extremes of 114° have been recorded at Beardsley, while a short distance away a low of -47° was recorded at Alexandria. These extreme temperatures may be nearly as important as precipitation in their influence on wood-lot and shelterbelt development.

Topography and Soil

Within the area covered in this analysis, elevation ranges from about 700 to 1,200 feet above sea level and the topography is relatively level. There is some sharp relief along the Mississippi and Minnesota rivers which cross the area and about some of the glacial moraines.

All but the southeastern counties of Houston and Winona have been glaciated one or more times. Considerable time has elapsed since these ice sheets retreated and some of the soils in southeastern Minnesota show the influence of development under forest conditions. Likewise, those in southwestern Minnesota show the prairie influence.

Forest Industries

Southern Minnesota has about 775 sawmills, well distributed throughout the area. These mills are mostly small portable units but are capable of sawing all of the timber to be cut. However, dry kiln and planer facilities are not adequate to process the lumber being cut and most of it is used in a rough air-dry condition.

The following plants use limited quantities of local logs in the manufacture of finished products:

Iwen Box Company, Pine Island (cheese boxes and poultry crates)
Northern Cooperage Company, St. Paul (barrels)
Wahkon Box Company, Wahkon (berry box and egg crates)
Elk River Box Company, Elk River (berry boxes)
Minnesota Bee Supply Company, Buffalo (bee supplies and miscellaneous)
Bren Berry Box Company, Hopkins (berry boxes)
DeVal Stave and Heading Company, Winona (head and stave stock)
F. T. Smisek, Hopkins (baskets)

In addition to the sawmills and processing plants mentioned above, there are many manufacturing plants, especially in the Twin Cities area, that use lumber either for processing or crating and shipping of products. Most of this lumber is now shipped into Minnesota. A large part could be furnished from the managed wood lots of southern Minnesota.

Transportation Facilities

Southern Minnesota is traversed with a network of excellent highways, roads, and railroads, adequate for the movement of all wood-lot products. Most of these transportation facilities lead into the Minneapolis-St. Paul area where the majority of the manufacturing plants are located.

The Biotic Factors

No discussion of the research needs of the wood-lot area of southern Minnesota would be complete without consideration of biotic factors (diseases, insects, birds, and animals) likely to affect tree growth and wood-lot development.

To date little is known of the insects and diseases likely to attack plantings and managed wood lots. The basswoods and some other species have been defoliated several times; tip weevils have attacked coniferous plantings. The oak wilt has been common the past few years. As management and planting studies are developed, the insect and disease phase of the projects should be given close observation. Perhaps it will be necessary to develop special research projects to study these factors.

Tree growth, especially in the farm area, is the natural shelter of many birds and animals, such as songbirds, pheasants, rabbits, and deer. The interrelations of the wildlife and the vegetation in which it finds shelter will need to be carefully investigated to the end that the wood lots and tree planting can be made to support the maximum amount of wildlife without injuring their ability to protect the land from wind and water erosion or to produce timber crops.

TYPE OF RESEARCH PROJECTS RECOMMENDED

Research is needed in three broad fields: (1) Forest management, (2) tree planting, and (3) forest utilization.

1. Forest management. Management studies directed toward the improvement of immature stands and the harvesting of mature trees.
2. Tree planting. Planting studies dealing primarily with field and farmstead shelterbelt planting, but also some directed toward improving the composition of existing wood lots and converting low-value fields and pastures to forest.
3. Forest utilization. Research aimed at improving practices in logging, milling, and seasoning; and developing markets for southern Minnesota hardwoods, both as a cash crop and for use on the farm.

More detailed statements regarding the proposed research projects are given at the end of this report.

DEMONSTRATION

When analyzing many of the suggested research projects it may seem that they involve largely extension or educational work. This is not the intention. Research is needed on all of the projects listed but will, in most cases, not produce immediate results. The demonstration and educational value of many of these projects will be the first tangible returns from the experiments and should not be mistaken as the aim of the projects.

PHOTOGRAPHIC RECORD

A photographic record should be currently kept as a part of all research projects. For several years Mr. Lauer and other foresters in the Soil Conservation Service and CCC camps in southeastern Minnesota took a great many pictures of forestry subjects, including managed wood lots. In many cases locations and descriptions are still available. It is proposed that wherever possible and the subject warrants it, these pictures be repeated as a part of the permanent record. Following up on these pictures will no doubt bring to light demonstration wood lots, timber-stand improvement areas, plantations and plantation release projects which should be included in the other proposed studies.

REVIEW OF PAST WORK

A review of past research work in this area is covered in connection with the discussion of the individual projects. A bibliography of all published material and a brief resume of each is given at the end of this analysis.

PROPOSED WOOD-LOT MANAGEMENT RESEARCH

The wood-lot management research program proposed for southern Minnesota is divided into two broad groups of projects:

1. Short-range projects which can be completed in about a year.
2. Long-range projects which will require many years of observation and records before reliable results can be obtained.

Short-Range Project

The short-range project proposed is primarily a compilation and analysis of experiences in the oak and bottom-land-hardwood types of southeastern Minnesota. This would be largely a review of the work done by W. H. Lauer, Harry Callinan, Ray Cline, Lee K. Moore, H. G. Halvorson, Urban C. Nelson, Charles White, and other foresters in the Soil Conservation Service, and recording and analyzing their observations. The purpose of the project is to salvage the experience of these men, and make it available to conservation workers and wood-lot owners.

The findings of this project would be published in a handbook, which report would give the best obtainable advice on such matters as the effects of different methods of cutting on reproduction, growth, and survival; include experiences in fencing of wood lots against grazing; results of supplemental planting to restock stands, and of planting for gully control; and the effect of wood lots on erosion control.

A portion of the handbook would be devoted to the utilization and marketing of the products of the wood lot.

Long-Range Projects

The long-range projects include the following suggested research:

- A. Growth, mortality, and reproduction studies in the various timber types under different management practices.
- B. Effects of grazing on wood-lot management.
- C. A cull study of the important hardwood species.
- D. A cost-accounting study of woodland management.

Growth, Mortality, and Reproduction Studies in Managed Wood Lots in Southeastern Minnesota

Since 1945 Wilfred H. Lauer, Jr., Farm Forester at Winona, has marked about 40 wood lots in Winona, Houston, Fillmore, and Olmsted counties for partial cutting. Fairly complete cruise data and marked tree records are available for many of these areas which have now been logged.

The marking policy used for these cuttings has been largely based on Mr. Lauer's observations and judgment, following more than 10 years' experience in this area. If foresters and landowners are going to profit fully from these cuttings--growth, survival, and reproduction information must be obtained. To accomplish this, it is proposed to establish a number of 1/5-acre growth plots on units where the cooperation of the owner can be obtained. These 1/5-acre plots should be distributed over the major timber types, size classes, soil conditions, and topography found in the area. A minimum of 5 plots will be obtained from comparable species, size, site, and soil conditions in each wood lot. Final results from this study cannot be expected until the plots have been remeasured. These plots will serve also as excellent demonstration areas for county agents and other agricultural leaders in promoting better cutting practices.

Similar plot establishment could be made on farmwoods marked for cutting by Callinan, Cline, and other Soil Conservation Service foresters since the start of the Soil Conservation program.

Survey of older cuttings in southeastern Minnesota wood lots. Since about 1938, Mr. Lauer, Mr. Callinan, and other Soil Conservation and CCC camp personnel have made numerous cutting demonstrations in wood lots of southeastern Minnesota. Not many records are available, but the men who did the work still remember much of the information regarding the units worked. Such areas have an important advantage--they have been under management for several years. Perhaps 20 to 30 of these older managed wood lots can be found. A systematic survey of results from these cuttings, and contacts with the men who supervised the work, could produce tentative conclusions of immediate value to farm foresters and the Soil Conservation Service. Where sufficient records are available and conditions are satisfactory, 1/5-acre plots should be established the same as planned for the more recent cuttings.

Tamarack swamps. Tamarack occurs in stands of considerable extent on farm wood lots in central Minnesota. Such stands usually are included in grazed wood lots, but the land on which they grow offers little opportunity for satisfactory grazing or crop production. Even at small sizes, tamarack is valuable for posts and poles. Large acreages of tamarack have been cut over. The species is intolerant and the result of cutting and grazing abuse is usually a dense and worthless stand of brush. Such swampy areas should remain in tamarack. A study of the management of this species in farm wood lots could add to farm-income possibilities. Improved management practices would reduce the fire hazard resulting when the cut-over swamp restocks with brush, weeds, and grass. A study of the reforestation possibilities of the grass and brushy swamp areas would also be desirable.

Cottonwood management and utilization. Cottonwood is one of the most common trees to reach sawlog size in southern Minnesota. Today, there is considerable mature and overmature cottonwood timber on the river bottoms. Many farm groves contain overmature cottonwood trees, which are hindering the development of ash and other more permanent species. Cottonwood growing along hundreds of miles of open drainage ditches is actually hindering drainage.

In the past, and even today, only a small part of this mature cottonwood has been harvested. Most of the trees are permitted to reach maturity and die. Many trees are currently cut down and the logs and tops left to rot. Some cottonwood logs are sawed into lumber but this is often poorly seasoned and unwisely used. In general, cottonwood has gained the unwarranted reputation of being a worthless tree. This is not true. Cottonwood is one of the fastest growing trees found in southern Minnesota - "Minnesota Wood Lot Yields Valuable Crop" (Technical Note #248) describes a stand that produced more than a cord per acre per year at 35 years of age. There are many examples of cottonwood being used successfully in farm-building construction and repairs. A survey and analysis of its uses, together with information on the availability of cottonwood in the various counties, would do much to promote the use of this species.

Resurvey of wood lots in southeastern Minnesota examined by Professors Cheyney and Brown in 1927. In 1927 Professors E. G. Cheyney and R. M. Brown, of the University's Forestry Division, examined 20 sample wood lots in southeastern Minnesota. The findings are published in "The Farm Wood Lot of Southeastern Minnesota - It's Composition, Value, Growth, and Future Possibilities," Minnesota Bulletin #241, September 1927, 28 pp. illustrated.

A resurvey of these wood lots would present a comparison of acreage, composition, and condition changes during the 20-year period. The value of such a resurvey would depend largely upon the findings of the original data, plot information, and pictures.

The value of farm woodlands in Carver County. In 1938, William A. Duerr and C. H. Simonds, of the Lake States Station, made a survey of Carver County. The results were typewritten and never published. A type map was made based on aerial photographs. More complete ^{and} data were taken on 95 sample farms, including a cruise of the woodland ^{and} interviews with the owners. A resurvey of this county on the same basis as in 1938 would give valuable information on the change in timber area and volume. Duerr predicted a continual decline of timber quality in the stands. This will be a fine opportunity to follow up on these observations. Findings for this county would be applicable to a larger area of central Minnesota.

Study of value of forest cover for retarding run-off and preventing soil erosion. A timber type map was made for Hokah township in Houston County several years ago by CCC, SCS, and Lake States Forest Experiment Station personnel. A revision of this map, using the current aerial pictures could be made at this time. This would show the stabilizing influence of timber on contour and strip farming for one area in southeastern Minnesota. A comparison of the two maps would indicate also the rate of timber depletion in southeastern Minnesota. This timber type map might provide a good project for a graduate student. The project should be developed in cooperation with the Soil Conservation Service.

Other areas offering similar opportunities for study include Gilmore Creek watershed, Whitewater drainage in Winona County, and the area around Yucatan in Houston County.

B. Effects of Grazing on Wood-Lot Management

Systematic observations of grazed and ungrazed wood lots under similar conditions would yield some much-needed information. Comparisons should include species distribution, mortality, stocking, growth, and reproduction. Mortality of the older trees and survival of reproduction are probably the most important angles of the study. The physical damage to soil due to the trampling of cattle should be noted. This project is not intended to replace the need for the establishment of permanent growth and mortality study plots, but some information of immediate use can be obtained by surveys before the long-time studies are completed. The results of such a study would be useful in guiding a proposed AAA program of payments for fencing wood-lot areas from grazing. The study areas will be useful demonstrations for county agents and Soil Conservation Service personnel. The cooperation of both the Soils and Agronomy departments of the University of Minnesota should be obtained for this project.

C. Cull Study of Hardwoods.

This study would develop a basis for judging the quality of standing timber for the various species of southern Minnesota hardwoods, with emphasis on the occurrence of hidden defects. Such a study is especially important for oak and basswood. The information would be of special value to farm foresters. The study should lead to the preparation of a simple tree classification which can be used by farmers in handling their wood lots.

D. Cost Accounting Study

For several years accurate cost-accounting records were kept for 20 to 30 wood lots near Winona, Minnesota. The results were included in Stanly S. Locke's article in the Journal of Forestry, Vol. 43, No. 10, October 1945, pp. 723-728, "Income from Farm Woodlands." With the start of the Farm Forestry action program in 1945 this accounting study was discontinued. It is proposed to re-establish this study as a research project. Many of the same farms could be included in the new study and samples drawn from other wood lots throughout southern Minnesota, taking somewhat less detailed information. It is also proposed to keep part of the records on an annual basis, part on a 5-year basis, and part on a 10-year basis. It is possible that this cost-accounting study could be correlated with the farm-accounting studies maintained on many Minnesota farms in cooperation with the Bureau of Agricultural Economics.

PROPOSED SHELTERBELT AND WOOD-LOT PLANTING RESEARCH

Planting of shelterbelts and farm wood lots present a series of problems including the following:

- Planting needs on the farms

 - The attitude of the owner toward planting

- Source of seed

- Nursery practice

- Selection of species for planting sites

- Preparation of the planting area

- Handling of the stock

- Planting methods

 - Machine planting

- Care of the plantation

 - Cultivation

 - Pruning

- Protection from fire, insect, disease, and animal damage

- Harvesting

- Renewing

- Costs and values

- Benefits to the owner

Partial answers to many of these problems can be obtained by surveys of past work and current observations on existing plantations. The answers to other questions will require the establishment of permanent observation areas.

To obtain a working knowledge of the points needed for guiding the farm wood-lot and shelterbelt planting program now being started, the following subprojects are recommended for early study:

1. Planting needs (Renville County survey)
2. Source of seed
3. Nursery practice (cutting and transplant nursery)
4. Selection of species (for sand, wet land, gullies)
5. Planting methods (direct seeding)
6. Renewing (supplemental planting)
7. Benefits to owner

1. Planting Needs

A sample survey would be made of 100 to 200 shelterbelt plantings in a representative southern Minnesota county with special emphasis on determining needs for replanting, extending present belts, etc.

The county recommended for survey is Renville, about 75 miles west of the Twin Cities. The purpose of the survey would be threefold: (1) To determine survival and growth of the present shelterbelt according to source of stock. This survey would include only shelterbelts with a long-time personal observation of the owner or some local person who could give origin of stock, storm damage, etc. It would be helpful also to secure information on the farmer's interest and attitude toward these plantings. This study should give a fairly accurate picture of the potential planting requirements for Renville County.

The extent of use of these shelterbelts for wildlife and shelterbelt improvement needed to develop the wildlife habitat should be an important part of this study. (2) To determine the adequacy of protection given the farm buildings or the fields by the present shelterbelt. (3) To determine the amount of cultural work needed and extra planting required to bring the shelterbelt to the desired standard.

After the completion of Renville County, the project might be expanded to sample counties in other parts of the State.

2. Source of Seed

The Division of Forestry of the University of Minnesota plans to develop a comprehensive program on source of seed in connection with the Mayo Foundation. This will be of direct application, however, only to part of southeastern Minnesota.

Source-of-seed studies have been started at Purdue University and elsewhere on walnut. There are many walnut trees in southern Minnesota. A considerable amount of land needing reforestation is suitable for the use of this species. A walnut source-of-seed study could be started in Minnesota. This source-of-seed study could be expanded to include straight-grain cottonwood, elm with a central stem, black locust, basswood, and, perhaps, other species. The Hormel Foundation might also be interested in this type of experiment.

Studies of adaptability of shrub and tree species for shelterbelt planting should be included in this project.

3. Nursery Practices

A. Cutting and Transplant Nursery

Since southern Minnesota does not have a public tree nursery (the Soil Conservation Service at Winona serves several states), or contemplate having any in the near future, the development of local cutting and transplant beds would greatly aid in advancing the planting program. These small nurseries could be developed in connection with the Soil Conservation districts, 4-H Club units or other public agencies. The development of these small nurseries would be largely an action program. It would, however, be on an experimental basis and research work in soils, watering, spacing, etc., would be needed before the program could be adapted for wide-scale use.

4. Selection of Species

A. Resurvey of Demonstration Plantations

From 1920 to 1926 the Division of Forestry, University of Minnesota, made 330 plantings in various townships throughout Minnesota, mostly in the western counties. These plantings have now had 20 or more years of growth. A partial remeasurement (64 plantations) was made in 1936 and the results published by Henry L. Hansen and Henry Schmitz: "A Resurvey of the Demonstration Shelterbelts in Minnesota," Bul. #337, University of Minnesota Agricultural Experiment Station, December 1938, 16 pp., illus. These plantations are again ready to be remeasured. The project might well be expanded to include all of the original plantings.

B. Older Field Plantings

There are scattered over the 62 southern counties of Minnesota some very fine plantations. Those at St. John's College at Collegeville, Scotch and red pine southwest of Cannon Falls, walnut southwest of Mankato, and white pine near Money Creek are examples. Some of these plantings were made many years ago. It is proposed that these plantings be examined for growth, survival, release done or needed, and extent of damage by animals, insects, disease and storms. The results from this study would be a useful experience guide to a planting program for the farming area of the State.

C. Field Shelterbelt Planting in Sandy Areas

Field shelterbelts must play an important part in stabilizing the farm practices and field size and location in the sandy areas of Sherburne, Anoka, and Isanti counties, and similar areas throughout Minnesota. Since these sandy farm areas are included in Soil Conservation districts, the development of this field shelterbelt planting program should be in cooperation with the Soil Conservation Service. The analysis of existing field shelterbelts in these counties would be part of this project.

D. Planting Wet Land

Many farms in southern Minnesota contain a considerable acreage of land too wet for crop production or for good pasture. This land often floods during wet periods. Many of these areas originally were covered with tamarack, cottonwood, and other moist-soil tree species. Today, they are largely covered with brush and grass, and are definitely a waste part of the farm. In some cases cheap and effective drainage might convert the area to pasture or crop production. In most cases, however, tree crops seem to offer the best use of the land. The problem is what species to plant, how to prepare the soil, and what amount of cultural work or release will be necessary. Examples of this type of land are found in every county in southern Minnesota. The bulk of the area, however, occurs in the west and central part of the State. Much of the land between the base of the hills on either side of the Minnesota River would be included in this project.

E. Black Locust in Southeastern Minnesota

Black locust has been used extensively by the Soil Conservation Service in gully control in southeastern Minnesota. For the purpose of stabilizing gullies, the species has been successful. In some cases it has developed into trees usable for fence posts, while in others it is little more than a brush cover. The locust borer has been active in some stands and apparently missing in others. Some trees show winter killing. The origin of the seed may have been an important factor. A study of the plantings made by the Soil Conservation Service during the past 12 years would answer most of the questions regarding the use or abandonment of this species. Such a study is recommended before an extensive planting program is undertaken in southern Minnesota.

F. Production and Marketing Administration (Farm Planting Program)

A considerable acreage of trees has been planted on farms in Minnesota under the AAA payment program. A sample survey of these plantings to obtain growth and survival for the various species would be helpful in planning a general planting program. It would also show the effectiveness of a payment plan for securing reforestation in farm areas. The survey could be carried out in one or more counties or with a smaller sample on a state-wide basis.

5. Planting Methods

A. Direct Seeding

Many wood lots, as a result of heavy grazing or other causes, contain little or no reproduction. In other wood lots, trees of desirable species are missing both in the overstory and in the reproduction. Planting stock is not available in adequate quantities. In the case of oak and walnut, it is difficult to grow the stock in the nursery and transplant it to the field.

Under these and other conditions, the direct seeding of the various species could be tried out. These direct seeding experiments could be started in southeastern Minnesota and later extended to other areas. This method might also be satisfactory for the introduction of ash and other species under the cottonwood overstory. Some of the seed spots, in all tests, should be protected against birds, rodents, and other animals. Wherever possible, some comparison with planted stock should be provided.

6. Renewing

A. Supplemental Planting

In many cases native wood lots are not well stocked. This is especially true where the timber has been grazed for many years and is now being fenced for a wood lot. In order to speed up the restocking of these areas, supplemental planting is necessary. So far very little of this type of planting has been done. It is essential that such experiments be started to furnish a basis for future planting recommendations. Many of the areas marked by Lauer under the farm-forestry action program would be available for the project. Some of the public parks, roadside tracts, and wildlife areas, such as the Whitewater Drainage in Winona County, could be used for this experiment.

7. Benefits to Owner

A. Direction and Composition of Effective Field Shelterbelts and Fence Row Plantings

Beneficial effects of field shelterbelt plantings often occur within a narrow belt adjacent to the planting. The favorable influence is often the result of the increased moisture from the snow caught in the area and is more likely to be found on the south and east sides. With the drifting snow came fine soil particles, and with this drifting an accumulated beneficial effect of the belt is quite possible. The width to which this benefit will be felt depends upon the direction of the belt and its composition and age. Narrow belts of tall, fairly open trees might give the maximum of benefit to the adjoining area. These are just some suggestions. This subject should be given thorough study--preferably in cooperation with the Soils and Agronomy Department of the University. The Soil Conservation Service might also be interested in cooperating on this project.

PROPOSED UTILIZATION RESEARCH

Utilization research is divided into two groups: (1) Home use of the forest products from the farmwoods, and (2) marketing of surplus wood-lot products.

The home use of lumber is further divided into the following suggested sub-projects:

- (a) Lumber requirements of representative Minnesota farms.
- (b) Availability of local wood for construction and maintenance.
- (c) Representative cost and experience data.
- (d) Fuelwood, fence posts, poles, and miscellaneous products.

Marketing is further divided into subprojects:

- (a) Periodic marketing letter.
- (b) Standardization of grades.
- (c) Development of new industries.

Proposed projects covering some of the above-mentioned points follow.

Home Use of Farm Products

A. Lumber Requirements of Representative Minnesota Farms

A survey of the lumber requirements of Minnesota farms, based on the size of the farm, type of agriculture, and the maintenance and replacement of present farm structures is proposed. This is a large undertaking and should be done in cooperation with the Forest Products Laboratory and, perhaps, the Agricultural Engineering Department of the University of Minnesota. Such a requirement study should also be correlated with the available timber supply in the farm wood lot.

B. Availability of Local Woods for Construction and Maintenance

The reappraisal in the wood-lot area should be directed toward obtaining information on the availability of local woods for local needs.

C. Representative Cost and Experience Data

Most farm wood lots are small, with a possible annual cut of only a few hundred board feet. The local farm remains the best market for these small quantities of lumber. Many farmers do not realize that their mature trees will make useful lumber. "Home Grown Timber for Farm Buildings," by Charles H. White tells an interesting story, but does not answer many of the questions raised by the prospective users. The farmer wants to know how soon after sawing he can use the green lumber in a building. What shrinkage should be expected when this green lumber is used? Will the nails hold when the lumber dries? How does the strength of cottonwood and other local hardwoods compare with Douglas fir for floor joists? Does basswood make good siding? Many other practical questions, for which we do not have answers, could be included. Several research studies could be started in cooperation with the Agricultural Engineering Department. Certain of these questions might make good subjects for graduate study. A survey of planer and dry-kiln facilities should give valuable information and promote increased use of local lumber on the farms.

D. Fuelwood, Fence Posts, Poles, and Miscellaneous Products

1. Fence posts

As more and more wood lots and shelterbelts come under intensive management the axe and saw will find increasing use. Small trees will be har-

vested to make room for others to grow. A market for these small trees is desirable. Fence posts for the farm offer a possibility. Small sizes and species previously considered inferior - such as aspen - can now, with preservative treatment, be used. Expansion of the treatment of posts is essential to good wood-lot management. Effectiveness of different chemicals in treating different species of posts to be used under different soil conditions should be given further study.

2. Maple syrup

Hard maple is a common tree in many wood lots in southern Minnesota. It is especially important in the central part of the State, west of Minneapolis. A few owners, especially around Lake Minnetonka and Mille Lacs Lake, have developed a small maple syrup industry, both for their own use and for sale. The expansion of this industry has great possibilities in the State. It is hindered, however, by the lack of knowledge of yields, season of operation, tapping and collecting methods and modern processing procedure.

Considerable research work has been done in other sections of the United States (particularly in the Northeast and the Ohio Valley) on maple syrup production. It is proposed to develop a research project in Minnesota, first for testing the known methods and procedures and then to carry on additional research as needed to adapt these findings to Minnesota conditions. The development of more modern methods of boiling down the syrup appears to offer the greatest possibilities for study.

Marketing of Surplus Production

A. Marketing Service for Farm Wood-Lot Owners and Small Mill Operators

Many of Minnesota's 188,000 farms have a wood lot that can supply more lumber and fuel, and other wood products, than are needed on the farm. The owner usually does not know how to dispose of any surplus production, nor where to look for a market. If a buyer could be found, the question of a fair price for these forest products often arises.

We cannot expect good wood-lot management until these surplus products can be sold easily and satisfactorily. A marketing service in which current markets and price information is compiled and periodically released to the operators, would do much to promote wood-lot management.

Since most of the sawmills are owned by small wood-lot owners, practical information on better sawing, seasoning, and improved logging methods would be useful. This information could be released in connection with the market reports. The extension service has a vital interest in such a project.

B. Standardization of Grades

1. Completion of Log and Lumber Grading Study

About 1944 a log and lumber grading study was started in Winona County. The data collected have been only partly computed. These data may not be in the best form for such a study, still they contain sufficient information to justify the completion of the project.

2. Tree, Log, and Lumber Grading Study

A tree, log, and lumber grading study, based upon a sound sampling procedure is recommended for southern Minnesota hardwoods. Such a study would represent a considerable job with help needed during the period of sawing.

3. Aspen Grading Study

In 1945-46 Professor Rees made a study of the use of aspen in local building construction. The report from this study is now in preparation. The industrial grading of aspen is being studied at the Minnesota Research Center, Grand Rapids, Minnesota. The structural grading of aspen in relation to home use was not undertaken and is recommended for study. This project might be expanded to include the structural grading of all southern Minnesota hardwoods.

ANNOTATED BIBLIOGRAPHY

(1) Anderson, Parker O.

1942. Planting the standard windbreak. Minn. Ext. Bul. #196, 16 pp.
illus. Univ. of Minn., St. Paul, Minn.

This bulletin discusses the need for a windbreak, describes a typical standard 10-row windbreak, and then discusses and illustrates planting methods and procedures. Some mention is made of the care of the established windbreak.

(2) _____

1946. Windbreaks for field protection. Ext. Folder No. #1140, 6 pp.,
illus. Univ. of Minn., St. Paul, Minn.

Diagrams and a short description of proposed field shelterbelts are presented. Three-row pine and juniper, three-row cottonwood and conifer, and four or more row cottonwood and shrubs are recommended.

(3) Cheyney, E. G., and Brown, R. M.

1927. The farm woodlot of southeastern Minnesota, its composition,
volume, growth, value, and future possibilities. Minn. Bul.
#241, 28 pp., illus.

This bulletin is based on the examination of 20 sample plots covering 14 acres in southeastern Minnesota. Thirteen of these plots were in a mixed hardwood type and seven in the oak type. Stand tables are presented for each type also growth records for the various species. These study areas were chosen by the county agents and probably represent the best conditions rather than average wood lots. Fire hazard, grazing, and value are discussed briefly.

(4) Cheyney, E. G.

1931. Establishment, growth, and influence of shelterbelts in the
prairie region of Minnesota. Univ. of Minn. Agric. Exp. Sta.
Bul. #285, 36 pp., illus.

A discussion is presented of a survey of older plantations in the western counties of Minnesota made in 1926. Information on soil

moisture, temperature, wind velocity, and relative humidity both inside and adjacent to the shelterbelts are presented, also information on growth by species.

The remainder of the bulletin deals with a discussion of the demonstration windbreaks established by the Division of Forestry in the prairie counties from 1920-1926. The results of remeasuring the 5-, 6-, and 7-year-old plantings are presented in numerous tables showing effects of cultivation by species and a brief discussion of each species used.

Green ash, American elm, jack pine, and white spruce were concluded to be the most promising species both as to survival and growth. Cultivation increases growth from 10 to 50 percent. Rabbit injury was a serious factor on nearly all shelterbelts examined.

(5) Christopherson, C. H., and Rees, L. W.

1945. Home-grown timber for farm buildings. Minnesota Farm and Home Science, Vol. II, No. 2, 3 pp., illus.

This is an interesting discussion of the use of home-cut lumber as it is being encouraged by the Division of Agricultural Engineering and Division of Forestry of the University, the Lake States Forest Experiment Station, the Agricultural Extension Service, and the Soil Conservation Service. How to plan a building, how to process the lumber, and some pointers on building are discussed. The strength and nailing and painting properties of native hardwood lumber are discussed briefly. In conclusion, the probable cost savings by using home-cut lumber are covered.

(6) Deters, M. E.

1943. Silvicultural aspects of woodland management in southeastern Minnesota. Tech. Bul. No. 157, 71 pp., illus. Univ. of Minn. Agric. Exp. Sta., St. Paul, Minnesota.

This study was made of the wood lots in the 17 southeastern counties of Minnesota. The oak-hickory and maple-basswood types were recognized.

In general, the oak-hickory type was found on the drier sites. The stands were generally even-aged. Reproduction was rare in this type. Where reproduction was found it was of the maple-basswood climax species. Oak-hickory stands were generally understocked.

The maple-basswood climax type was usually better stocked and unless heavily grazed contained considerable reproduction. This type was generally all aged and was more often found on the more moist sites.

(7) Deters, M. E., and Henry Schmitz

1936. Drought damage to prairie shelterbelts in Minnesota. Univ. of Minn. Agric. Exp. Sta. Bul. #329, 28 pp., illus.

In 1934 a study was made of all the tree plantings on each farm in 11 selected townships (one each in Martin, Blue Earth, Murray, Redwood, McLeod, Meeker, Lac qui Parle, Big Stone, Stevens, Wilkin, and Norman counties). Records were obtained from 665 farms. Individual trees were classified as to species, size, and condition. On these farms 179,703 trees were found, or 270 trees each. In the shelterbelts examined, 36 species were found and 28 of these species had a sufficient number of trees to be given consideration. The summary discusses each of the 28 species as to survival, growth, and recommended use. Cultivation of new plantations is recommended. It is pointed out that 5 percent of the farm area (900,00 acres), or 8 acres per farm should be in wood lot. Based on a 40-year rotation, this would require 22,000,000 seedlings and cuttings annually.

(8) Duerr, William A., and Simonds, C. H.

1940. The value of farm woodlands in Carver County, Minnesota.

63 pp. typewritten. Lake States Forest Experiment Station.

This paper describes the timber area of Carver County from the time of the first settlement until 1938. The information presented is based on the type map compiled for the county and detailed data for 95 sample farms.

The timber area had changed little in the previous 40 years but a big change had occurred in density and stand conditions due to heavy grazing. Grazing will eventually destroy a timber stand. Duerr points out that logging of grazed areas accelerates this destruction.

In 1938 the value of timber harvest was \$138,000 or \$86 per farm, or \$3.21 per acre. Under good management Duerr believes this return could be nearly doubled.

(9) Hansen, Henry L., and Schmitz, Henry

1938. A resurvey of the demonstration prairie shelterbelts in Minnesota. University of Minnesota Agric. Exp. Sta. Bul. #337, 16pp., illus.

This bulletin covers the analysis of 64 of the 320 demonstration shelterbelts which were established. This resurvey was confined to Lincoln, Lyon, Stearns, Wilkin, and Kittson counties. Charts giving

survival and growth by species are presented--also a comparison of survival on heavy and light soils. Some discussion is presented on shelterbelt management. Of some 25 species planted, only green ash and boxelder gave good survival after 13 to 15 years. American elm, Caragana, silver maple, and northwest poplar were fair. Jack pine was the best of the conifers with about 28 percent survival.

(10) Lake States Forest Experiment Station

1946. Introduction to reports of the forest survey of the Lake

States -- purpose, methods, standards, and definitions.

Economic Note #4, 24 pp., St. Paul, Minn.

This publication gives type descriptions for southern Minnesota forest land.

(11) _____

1937. The forest situation in the hardwood and prairie districts

of Minnesota. Economic Note #6, Univ. Farm, St. Paul, Minn.

This publication presents tables and a discussion of the timber resource of the area. Information on the timber drain is also included. Discussions include conditions of shelterbelts, insects, and disease in the wood lots and management practices. While this area was not covered as completely as the rest of the state by the Forest Survey, still much valuable information was collected and presented in this report.

(12) Locke, Stanley S.

1945. Income from farm woodlands. Jour. Forestry, Vol. 43, #10, pp. 723-728.

This article includes the farm wood-lot cost-accounting records for Winona County together with those from adjoining states. A total of 89 cases are included in the table and discussion. Wood lots are divided into high, medium, and low income groups. The high income group returned \$8.50 per acre or \$1.33 per hour spent. The medium group, \$1.92 per acre and \$0.67 per hour, while the low income group showed a loss of \$0.23 per acre and a return of only \$0.26 per hour spent. Maple syrup production is largely responsible for the extremely high returns from the high income groups.

(13) Neetzel, J. R.

1946. Minnesota wood lot yields a valuable crop. Technical Note

#248, Lake States Forest Experiment Station, St. Paul, Minn.

This technical note presents information on a 35 year-old cottonwood wood lot near St. Peter, Minnesota. Some trees were 30 inches in diameter at 35 years. This river bottom stand showed an average growth of 400 board feet per acre per year for the period.

(14) United States Department of Agriculture - Soil Conservation Service

1942. Home-grown lumber - saw it from your own woods. 4 pp., illus.

Leaflet encouraging use of home-grown lumber and telling briefly how to cut, season, and use the lumber; also manage the timber. Issued in cooperation with the State Extension Service. Diagram on cover is small building on Mrs. Emily Knopp's farm at west edge of Winona, Minnesota.

(15) _____ - Weather Bureau

Climatological summary of the United States, 1930. Sec. 45, southwestern Minnesota; Sec. 46, southeastern Minnesota.

These reports summarize the weather records for all cooperating stations. The extent and length of records vary between stations. These tables were used to secure a brief summary of precipitation and temperatures for southern Minnesota.

(16) United States Department of Commerce - Bureau of the Census

1936. Minnesota statistics, by counties.

This summary gives the number of farms, total farm acreage, and grazed and ungrazed wood-lot acreage by counties, 1935.

(17) _____

1946. Minnesota statistics, by counties, 1945. Vol. 1, part 8.

This summary gives the number of farms, total farm acreage, and grazed and ungrazed wood-lot acreage, by counties for 1945.

(18) University of Minnesota

1940. Pruning young windbreak trees. Extension Folder 91, 6 pp., illus., St. Paul, Minn.

This leaflet illustrates and describes the reduction of sprouts, avoiding sharp crotches, avoiding double tops, pruning snow catch and thinning to increase growth. One diagram is devoted to pruning evergreens when small and a second to restoring tips of injured evergreens.

(19) University of Minnesota

1942. Tips on tree planting. Extension Folder #85, 4 pp., illus.

St. Paul, Minnesota

Describes native species as to hardiness and value for products. The care of trees on arrival and planting is also discussed. A brief statement is made regarding native stock and cuttings.

(20) White, Charles H.

1942. Home-grown timber for farm buildings. University of Minnesota Extension Bul. #238, 16 pp., illus.

This is a very interesting story in word and pictures of the use of locally cut lumber in local houses, barns, and other farm structures. Cost records are presented for several structures.